CLAIMS

What is claimed is:

1. A method of controlling a disc drive using a counter-electromotive force, the method comprising:

detecting a voltage applied to a voice coil during a predetermined mode;

performing an operation of the value of the counter-electromotive force using the voice coil voltage;

comparing the value of the counter-electromotive force operated with a predetermined threshold; and

when the value of the counter-electromotive force is equal to or larger than the predetermined threshold, controlling a voice coil motor and a spindle motor so that a current mode is stopped and a parking or unloading mode is executed.

2. The method as claimed in claim 1, wherein the counter-electromotive force e(t) is obtained by:

$$e(t) = v(t) - L \times (\frac{di}{dt}) - R \times i(t)$$

where, *v(t)* is a voltage detected from the voice coil, *L* is a reactance constant of the voice coil, *R* is a resistance toward the voice coil from a VCM driver, and *i* is current applied to the voice coil.

3. The method as claimed in claim 1, wherein the predetermined mode is selected among a loading mode, a seek mode, a track following mode, a read mode, and a write mode.

4. The method as claimed in claim 1, wherein the predetermined threshold is calculated from a regression function corresponding to a statistical correlation between the magnitude of an external shock and the counter-electromotive force.

5. A method of controlling a disc drive using a counter-electromotive force, the method comprising:

detecting a moving distance variation $\Delta Lh/\Delta t$ of a transducer with respect to a variation in time during a predetermined mode;

performing an operation of a value of the counter-electromotive force by applying the detected moving distance variation ΔLh/Δt of the transducer with respect to the variation in time to a predetermined counter-electromotive force calculation Equation;

comparing the value of the counter-electromotive force with a predetermined threshold; and

when the value of the counter-electromotive force is equal to or larger than the predetermined threshold, controlling a voice coil motor and a spindle motor so that a current mode is stopped and a parking or unloading mode is executed.

6. The method as claimed in claim 5, wherein the predetermined counter-electromotive force calculation Equation is

$$e(t) = (\frac{Ke}{Rh}) \times (\frac{dLh}{dt}),$$

where, Ke is a counter-electromotive force constant, and Rh is a distance from a pivot bearing to a transducer.

7. The method as claimed in claim 5, wherein the predetermined mode is selected among a loading mode, a seek mode, a track following mode, a read mode, and a write mode.

8. The method as claimed in claim 5, wherein the predetermined threshold is calculated from a regression function corresponding to a statistical correlation between the magnitude of an external shock and the counter-electromotive force.

9. A disc drive, comprising:

a disc having a surface;

a spindle motor to rotate the disc;

a transducer to write and read information in and from the disc;

a voice coil motor to move the transducer; and

a controller to control the spindle motor and the voice coil motor according to a set mode, and to perform a shock damage prevention process of controlling the voice coil motor and the spindle motor, so that a current mode is stopped and a parking or unloading mode is executed if a counter-electromotive force operation process of performing an operation of a value of a counter-electromotive force using a voltage detected from the voice coil and the value of the counter-electromotive force are equal to or larger than a predetermined threshold value.

10. The disc drive as claimed in claim 9, wherein the counter-electromotive force e(t) is obtained by:

$$e(t) = v(t) - L \times (\frac{di}{dt}) - R \times i(t)$$

where, *v(t)* is a voltage detected from the voice coil, *L* is a reactance constant of the voice coil, and *R* is a resistance toward the voice coil from a VCM driver, and *i* is current applied to the voice coil.

11. The disc drive as claimed in claim 9, wherein the predetermined mode is selected among a loading mode, a seek mode, a track following mode, a read mode, and a write mode.

12. The disc drive as claimed in claim 9, wherein the predetermined threshold is calculated from a regression function corresponding to a statistical correlation between the magnitude of an external shock and the counter-electromotive force.

13. The disc drive as claimed in claim 9, wherein the controller further comprises:

a circuit to compensate signal delay between a driving signal to drive the voice coil motor and a voltage detection signal from the voice coil.

14. A disc drive, comprising:

a disc having a surface;

a spindle motor to rotate the disc;

a transducer to write and read information in and from the disc;

a voice coil motor to move the transducer; and

a controller to control the spindle motor and the voice coil motor according to a set mode, and using a moving distance variation $\Delta Lh/\Delta t$ of the transducer with respect to a variation in time detected during the set mode Δt, to perform a shock damage prevention process of controlling the voice coil motor and the spindle motor, so that a current mode is stopped and a parking or unloading mode is executed if a counter-electromotive force operation process of performing an operation of the value of a counter-electromotive force using a predetermined counter-electromotive force calculation Equation and the value of the counter-electromotive force of which operation is performed in the counter-electromotive force operation process are equal to or larger than a predetermined threshold value.

15. The disc drive as claimed in claim 14, wherein the predetermined counter-electromotive force calculation Equation is

$$e(t) = (\frac{Ke}{Rh}) \times (\frac{dLh}{dt}),$$

where, Ke is a counter-electromotive force constant, and Rh is a distance from a pivot bearing to the transducer.

16. The disc drive as claimed in claim 14, wherein the predetermined mode is selected among a loading mode, a seek mode, a track following mode, a read mode, and a write mode.

17. The disc drive as claimed in claim 14, wherein the predetermined threshold is calculated from a regression function corresponding to a statistical correlation between the magnitude of an external shock and the counter-electromotive force.

18. A computer readable storage storing at least one program to control a disc drive using a counter-electromotive force according to a process comprising:

detecting a voltage applied to a voice coil during a predetermined mode;

performing an operation of the value of the counter-electromotive force using the voice coil voltage;

comparing the value of the counter-electromotive force operated with a predetermined threshold; and

when the value of the counter-electromotive force is equal to or larger than the predetermined threshold, controlling a voice coil motor and a spindle motor so that a current mode is stopped and a parking or unloading mode is executed.

19. The computer readable storage as claimed in claim 18, wherein the counter-electromotive force e(t) is obtained by:

$$e(t) = v(t) - L \times (\frac{di}{dt}) - R \times i(t)$$

where, *v(t)* is a voltage detected from the voice coil, *L* is a reactance constant of the voice coil, *R* is a resistance toward the voice coil from a VCM driver, and *i* is current applied to the voice coil.

20. The computer readable storage as claimed in claim 18, wherein the predetermined mode is selected among a loading mode, a seek mode, a track following mode, a read mode, and a write mode.

21. The computer readable storage as claimed in claim 18, wherein the predetermined threshold is calculated from a regression function corresponding to a statistical correlation between the magnitude of an external shock and the counter-electromotive force.

22. A computer readable storage storing at least one program to control a disc drive using a counter-electromotive force according to a process comprising:

detecting a moving distance variation $\Delta Lh/\Delta t$ of a transducer with respect to a variation in time during a predetermined mode;

performing an operation of a value of the counter-electromotive force by applying the detected moving distance variation $\Delta Lh/\Delta t$ of the transducer with respect to the variation in time to a predetermined counter-electromotive force calculation Equation;

comparing the value of the counter-electromotive force with a predetermined threshold; and

when the value of the counter-electromotive force is equal to or larger than the predetermined threshold, controlling a voice coil motor and a spindle motor so that a current mode is stopped and a parking or unloading mode is executed.

23. The computer readable storage as claimed in claim 22, wherein the predetermined counter-electromotive force calculation Equation is

$$e(t) = (\frac{Ke}{Rh}) \times (\frac{dLh}{dt}),$$

where, Ke is a counter-electromotive force constant, and Rh is a distance from a pivot bearing to a transducer.

24. The computer readable storage as claimed in claim 22, wherein the predetermined mode includes a loading mode, a seek mode, a track following mode, a read mode, and a write mode.

25. The computer readable storage as claimed in claim 22, wherein the predetermined threshold is calculated from a regression function corresponding to a statistical correlation between the magnitude of an external shock and the counter-electromotive force.

26. A method of controlling a disc drive having a transducer and a disc by using a counter-electromotive force, the method comprising:

calculating the counter-electromotive force using a voice coil voltage or a position error signal without installing an additional shock sensor to sense disturbance in the disc drive;

determining a magnitude of an external shock or a magnitude of vibration by the calculated counter-electromotive force; and

when the magnitude of an external shock or the magnitude of vibration determined by the counter-electromotive force exceeds a tolerance range of the disc drive, controlling the disc drive so that a current mode is automatically converted into a parking or unloading mode, preventing malfunctions of the disc drive due to collisions between the transducer and the disc.